

CLAIMS

1. A lens drive apparatus for moving lenses in a lens unit having an optical zoom function for use in an ultraminiature camera which uses lenses having an optically effective lens diameter of 7 mm or less, comprising:
- 10 first and second lens support members arranged in the front and back;
wherein each of said first and second lens members holds a prescribed number of lenses;
said first lens support member is fixed;
said second lens support member is made movable in the forward and
- 15 backward directions, and is constructed so as to stop at two prescribed positions in the forward and backward directions;
whereby it is possible to switch between two kinds of zoom magnification.
2. A lens drive apparatus for moving lenses in a lens unit having an
- 20 optical zoom function for use in an ultraminiature camera which uses lenses having an optically effective lens diameter of 7 mm or less, comprising:
first and second lens support members arranged in the front and back;
wherein each of said first and second lens members holds a prescribed number of lenses;
- 25 said first lens support member is made movable in the forward and backward directions, and is constructed so as to stop at two prescribed positions in the forward and backward directions;
said second lens support member is made movable in the forward and backward directions, and is constructed so as to stop at two prescribed positions in
- 30 the forward and backward directions;
whereby it is possible to switch between two kinds of zoom magnification by controlling the stopping positions of said first and second lens support members.

- 5 3. A lens drive apparatus for moving lenses in a lens unit having an optical zoom function for use in an ultraminiature camera which uses lenses having an optically effective lens diameter of 7 mm or less, comprising:
- first and second lens support members arranged in the front and back;
 wherein each of said first and second lens members holds a prescribed
10 number of lenses;
 said first lens support member is made movable in the forward and backward directions, and is constructed so as to stop at two prescribed positions in the forward and backward directions;
 said second lens support member is made movable in the forward and
15 backward directions, and is constructed so as to stop at three prescribed positions in the forward and backward directions;
 whereby it is possible to switch between three kinds of zoom magnification by controlling the stopping positions of said first and second lens support members.
- 20 4. The lens drive apparatus described in any one of Claim 1 ~ Claim 3, wherein the movement of at least one of said first lens support member and said second lens support member is carried out based on the output of a stepping motor.
5. The lens drive apparatus described in Claim 1 or Claim 2, wherein at
25 least one solenoid, relay or permanent magnet is used as an actuator to move said first lens support member and said second lens support member, whereby the switching of the two kinds of relative positional relationship can be controlled by moving the first and second lens support members in accordance with the output of the actuator.
- 30 6. The lens drive apparatus described in Claim 3, wherein said second lens support member receives the output of a stepping motor to move forward and backward, and said first lens support member is made movable by a biasing force from said second lens support member and is stopped at the two positions of a first

5 position in the state when said biasing force is not received, and a second position when being moved by said biasing force.

7. A lens drive apparatus for moving lenses in a lens unit having an optical zoom function for use in an ultraminiature camera which uses lenses having
10 an optically effective lens diameter of 7 mm or less, comprising:

first and second lens support members arranged in the front and back;

wherein each of said first and second lens members holds a prescribed number of lenses;

said first lens support member is fixed;

15 said second lens support member is made movable in the forward and backward directions, is constructed so as to stop at two fixed positions in the forward and backward directions, and is driven to move a minute distance at said fixed positions;

whereby it is possible to carry out operations which change optical zoom
20 and focus.

8. The lens drive apparatus described in Claim 7, wherein the minute movement at said fixed positions carries out movement by a feed pitch less than or equal to 50 μm for at least a 600 μm section front and back.

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9. The lens drive apparatus described in Claim 8, wherein the feed pitch of said minute movement is made less than or equal to several μm .

10. The lens drive apparatus described in any one of Claim 7 ~ Claim 9,
30 wherein a stepping motor is used as a drive source in drive means for moving said second lens support member, a lead screw is provided on the output shaft of the stepping motor, a lead nut is provided at a corresponding position of said second lens support member, and a linear operation is carried out by connecting the lead screw and the lead nut.

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11. The lens drive apparatus described in Claim 10, wherein said stepping motor is a flat type in which steps are arranged on the left and right of the rotor.

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